PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference GRM:BK:FP17528	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. **PCT/AU2003/000288**	International Filing Date *(day/month/year)* 12 March 2003	Priority Date *(day/month/year)* 12 March 2002
International Patent Classification (IPC) or national classification and IPC **Int. Cl.** [7] E04B 1/41		
Applicant UNIVERSITY OF WESTERN SYDNEY et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   [X] This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of **10** sheet(s).

3. This report contains indications relating to the following items:

   - I [X] Basis of the report
   - II [ ] Priority
   - III [ ] Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV [ ] Lack of unity of invention
   - V [X] Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI [ ] Certain documents cited
   - VII [ ] Certain defects in the international application
   - VIII [ ] Certain observations on the international application

Date of submission of the demand	Date of completion of the report
10 October 2003	1 July 2004
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **JOHN HO** Telephone No. (02) 6283 2329

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/AU2003/000288

I. Basis of the report

1. With regard to the elements of the international application:*

- [ ] the international application as originally filed.
- [X] the description, pages **1-34,** as originally filed,
  pages , filed with the demand,
  pages , received on with the letter of
- [X] the claims, pages , as originally filed,
  pages , as amended (together with any statement) under Article 19,
  pages , filed with the demand,
  pages **35-44,** received on **11 June 2004** with the letter of **11 June 2004**
- [X] the drawings, pages **1/10-10/10,** as originally filed,
  pages , filed with the demand,
  pages , received on with the letter of
- [ ] the sequence listing part of the description:
  pages , as originally filed
  pages , filed with the demand
  pages , received on with the letter of

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

- [ ] the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- [ ] the language of publication of the international application (under Rule 48.3(b)).
- [ ] the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- [ ] contained in the international application in written form.
- [ ] filed together with the international application in computer readable form.
- [ ] furnished subsequently to this Authority in written form.
- [ ] furnished subsequently to this Authority in computer readable form.
- [ ] The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- [ ] The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. [ ] The amendments have resulted in the cancellation of:
   - [ ] the description, pages
   - [ ] the claims, Nos.
   - [ ] the drawings, sheets/fig.

5. [ ] This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-50	YES
	Claims -	NO
Inventive step (IS)	Claims 1-50	YES
	Claims -	NO
Industrial applicability (IA)	Claims 1-50	YES
	Claims -	NO

2. Citations and explanations (Rule 70.7)

The following documents identified in the International Search Report have been considered for the purposes of this report:

D1 - FR 2711163 A1

Claims 1-50 meet the criteria set forth in PCT Article 33(2) for novelty. The prior art published before the priority date does not disclose the use of a connector between a structural component and a concrete body to resist shear forces between the structural component and the concrete body (as defined by independent claims 1), or the use of a connector assembly for connecting together a concrete body and a structural component in the form of a framework of steel beams (as defined by independent claims 16, 25, 28), or a clip section for coupling a connector and a connector element (as defined by independent claim 40)

The closest art, D1, relates to a shear transfer assembly for an expansion, contraction or construction joint between two monolithic pieces of concrete. D1 discloses a centrally located mandrel or sleeve, a coaxial load spreader and ribs permanently attaching the coaxial load spreader to the mandrel or sleeve. The ribs disclosed in D1 serve to transmit forces acting on the mandrel or sleeve to the coaxial spreader located external to the mandrel or sleeve. Due to the presence of the ribs, the shear transmitting device disclosed in D1 is only used to transmit shear from one structure to the other structure and is clearly not capable of resisting shear forces between a structural component and a concrete body as defined.
The appended claims add further features to those defined by the independent claims and are therefore also novel.

The claimed invention is not obvious in the light of any of the cited documents nor is it disclosed in any obvious combination of them. It is also considered that it would not be obvious to a person skilled in the art in the light of common general knowledge either by itself or in combination with any of these documents.

The invention defined in the claims is considered to meet the requirements of Industrial Applicability under Article 33(4) of the PCT because it can be made by, or used in, industry.

CLAIMS:

1. A connector assembly for connecting together a structural component and a concrete body wherein the connector assembly is capable of resisting shear forces between the structural component and the concrete body and includes:

(a) a connector adapted to be embedded in concrete and adapted to be attached to the structural component; and

(b) a connector element that is adapted to surround the connector and form a barrier that is spaced from the connector and confines concrete around the connector.

2. The connector assembly defined in claim 1 wherein the connector and the connector element are separate components and the connector assembly further includes a means for holding the connector element around the connector.

3. The connector assembly defined in claim 2 wherein the holding means is a clip extending between the connector and the connector element.

4. The connector assembly defined in claim 3 wherein the connector includes a shank with one end adapted to be embedded in concrete and the other end adapted to be attached to the structural component, and wherein the clip includes:

(a) a means for coupling the clip to a section of the connector element, and

(b) a plurality of legs formed from resilient

material that extend inwardly and have inner ends that describe an opening that can receive the shank of the connector, and which opening has a diameter that is less than that of the shank, whereby in use the legs deflect when the clip is pushed over the shank so that the shank extends through the opening and the inner ends of the legs contact the shank and thereby couple the clip to the shank.

5. The connector assembly defined in any one of claims 2 to 4 wherein the holding means is adapted to hold the connector element from the connector so that there is a spacing of at least 20 mm between the components.

6. The connector assembly defined in any one of claims 2 to 4 wherein the holding means is adapted to hold the connector element from the connector a spacing of at least 25 mm.

7. The connector assembly defined in any one of claims 2 to 4 wherein the holding means is adapted to hold the connector element from the connector so that there is a spacing of at least 30 mm.

8. The connector assembly defined in any one of claims 2 to 7 wherein the holding means is adapted to hold the connector element from the connector so that there is a spacing of at least the maximum size of aggregate in concrete in the concrete body between the components.

9. The connector assembly defined in any one of claims 2 to 7 wherein the holding means is adapted to hold the connector element from the connector so that there is a spacing of least 1.25 times the maximum size of aggregate in concrete in the concrete body.

10. The connector assembly defined in any one of

claims 2 to 7 wherein the holding means is adapted to hold the connector element from the connector so that there is a spacing of at least 1.5 times the maximum size of aggregate in concrete in the concrete body.

11. The connector assembly defined in any one of the preceding claims wherein the connector element is selected from the group which includes a ring of solid material, a ring of mesh, and a coil with small pitch windings.

12. The connector assembly defined in claim 11 wherein the connector element is a coil with small pitch windings and the ends of the coils are closed to facilitate the development of hoop stresses in the coil.

13. The connector assembly defined in claim 11 wherein the connector element is a continuous ring of solid material, such as steel.

14. The connector assembly defined in any one of the preceding claims wherein, in a situation in which the concrete body is supported by a profiled decking having an upstanding rib or ribs separated by pans and an underlying structural framework of beams, the connector element is annular.

15. The connector assembly defined in claim 14 wherein the connector element has a height approximately 60% - 80% the height of the rib or ribs on the decking.

16. A composite structure includes a structural framework of beams, a decking on the structural framework, a concrete body on the decking, and a connector assembly, the connector assembly including:

(a) a connector embedded in concrete and attached to the structural framework; and

(b) a connector element that surrounds the connector and forms a barrier that is spaced from the connector and confines concrete around the connector.

17. The composite structure defined in claim 16 wherein the connector assembly includes a means that holds the connector element around the connector.

18. The composite structure defined in claim 17 wherein the holding means is a clip extending between the connector and the connector element.

19. The composite structure defined in any one of claims 16 to 18 wherein the spacing of the connector element from the connector is at least 20 mm.

20. The composite structure defined in any one of claims 16 to 18 wherein the spacing of the connector element from the connector is at least 25 mm.

21. The composite structure defined in any one of claims 16 to 18 wherein the spacing of the connector element from the connector is at least 30 mm.

22. The composite structure defined in any one of claims 16 to 21 wherein the spacing of the connector element from the connector is at least the maximum size of aggregate in concrete in the concrete body.

23. The composite structure defined in any one of claims 16 to 21 wherein the spacing of the connector element from the connector is at least 1.25 times the maximum size of aggregate in concrete in the concrete body.

24. The composite structure defined in any one of

claims 16 to 21 wherein the spacing of the connector element from the connector is at least 1.5 times the maximum size of aggregate in concrete in the concrete body.

25. A shear connector assembly for use in construction of concrete composite structures having a concrete body supported by a decking on a structural framework, the shear connector assembly including:

(a) at least one shear connector stud adapted to be permanently fixed through the decking; and

(b) a connector element adapted to form a barrier surrounding at least one connector stud a spaced distance therefrom to confine the concrete around the stud.

26. The shear connector assembly defined in claim 25 further includes a means for holding the connector element around the connector stud and concentric of the stud.

27. The shear connector assembly defined in claim 26 wherein the holding means is a clip extending between the connector stud and the connector element.

28. A method of forming a composite concrete structure including:

(a) assembling a structural framework incorporating interconnected cross-beams and a decking mounted on the beams;

(b) permanently fixing connectors in the form of shear connector studs through the decking and aligned with the beams;

(c) positioning a connector element in relation to the decking wherein the element forms a barrier surrounding at least one connector stud a spaced distance therefrom; and

(d) pouring concrete on the decking to form a composite structure.

29. The method defined in claim 28 further includes distancing the connector stud and the surrounding connector element from the decking rib at which concrete failure is most likely to occur.

30. A clip for use with the connector assembly defined in any one of the preceding claims includes:

(a) a means for coupling the clip to a section of the connector element, and

(b) a plurality of legs formed from resilient material that extend inwardly and have inner ends that describe an opening that can receive a section of the connector, and which opening has a diameter that is less than that of the connector section, whereby in use the legs deflect when the clip is pushed over the connector so that the connector section extends through the opening and the inner ends of the legs contact the connector section and thereby couple the clip to the connector.

31. The clip defined in claim 30 wherein the legs are formed to enable the legs to flex at least in one direction, when in use the clip is pushed over the connector to locate the clip on the connector.

32. The clip defined in claim 30 or claim 31 wherein the legs are formed to enable the legs to flex in two mutually perpendicular directions, when in use the clip is

pushed over the connector to locate the clip on the connector.

33. The clip defined in any one of claims 30 to 32 wherein at least one of the legs includes an upward crank.

34. The clip defined in claim 33 wherein the leg or legs that include the cranked end further include a section that is formed to increase the flexibility of the leg.

35. The clip defined in claim 34 wherein the by section is in the form of a curved bend in the leg outwardly of the cranked end.

36. The clip defined in any one of claims 30 to 35 wherein the inner ends of the legs are relatively wide to enable the legs to grip the connector section securely.

37. The clip defined in any one of claims 30 to 36 wherein the inner ends of the legs include projections that enable the legs to grip the connector section securely.

38. The clip defined in any one of claims 30 to 37 wherein the legs are formed so as to minimise interference to concrete flowing into the volume defined by the connector element that enclose the connector.

39. The clip defined in any one of claims 30 to 38 wherein the means for coupling the clip to the section of the connector element includes a plurality of clasps that can clip onto the section of the connector element.

40. A connector element assembly for use in a connector assembly for connecting together a concrete body and a structural component, wherein the connector assembly

includes the connector element assembly and a connector adapted to be embedded in concrete and adapted to be connected to the structural component, and the connector element assembly includes:

(a) a connector element that defines a barrier to confine concrete around the connector, and

(b) an integrally formed clip section for coupling the connector element to the connector.

41. The connector element assembly defined in claim 40 wherein the clip section includes a plurality of legs formed from resilient material that extend inwardly from a section of the barrier section and have inner ends that describe an opening that can receive a section of of the connector and have a diameter that is less than that of the connector section, whereby in use the legs deflect when the connector element is pushed over the connector so that the connector extends through the opening and the inner ends of the legs contact the connector section and thereby couple the connector element to the connector with the barrier section positioned to surround the connector.

42. The connector element assembly defined in claim 41 wherein the legs are formed so that the legs can flex at least in one direction, when in use the connector element is pushed over the connector to locate the connector element on the connector.

43. The connector element assembly defined in claim 41 or claim 42 wherein the legs are formed so that the legs can flex in two mutally perpendicular directions, when in use the connector element is pushed over the connector to locate the connector element on the connector.

44. The connector element assembly defined in any one of claims 41 to 43 wherein at least one of the legs includes an upward crank.

45. The connector element assembly defined in claim 44 wherein the leg or legs that include the cranked end further include a first leg section that is formed to increase the flexibility of the leg.

46. The connector element assembly defined in claim 45 wherein the first leg section is in the form of a curved bend in the leg outwardly of the cranked end.

47. The connector element assembly defined in any one of claims 41 to 46 wherein the inner ends of the legs are relatively wide to enable the legs to grip the connector section securely.

48. The connector element assembly defined in any one of claims 41 to 47 wherein the inner ends of the legs include projections that enable the legs to grip the connector section securely.

49. A method of manufacturing the connector element assembly defined in any one of claims 40 to 48 includes stamping a flat blank from a steel sheet, the blank having (a) a rectangular section that corresponds to the barrier section and (b) 4 elongate members extending from one side of the rectangle that correspond to the legs of the clip section, folding the rectangular section of the blank to form the barrier section, and shaping the elongate members to form the legs of the clip section.

50. A method of manufacturing the connector element assembly defined in any one of claims 40 to 48 includes pressing a cup-shaped member from a steel sheet, the cup-shaped member having a cylindrical wall that forms the

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barrier section, and stamping the base to form the legs of the clip section.